J Antimicrob Chemother 2012; **67**: 763–767
doi:10.1093/jac/dkr541 Advance Access publication 26 December 2011

Journal of Antimicrobial Chemotherapy

National cultural dimensions as drivers of inappropriate ambulatory care consumption of antibiotics in Europe and their relevance to awareness campaigns

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Received 12 July 2011; returned 2 November 2011; revised 7 November 2011; accepted 26 November 2011

Objectives: European countries exhibit significant geographical differences in antibiotic consumption per capita within ambulatory care, especially inappropriate use for colds/flu/sore throat (CFSt). One potential explanation could be national cultural differences resulting in varying perceptions and, therefore, influences.

Methods: Publicly available data on the proportions of respondents in the 2009 Eurobarometer survey who had taken antibiotics for CFSt were tested for association against country scores derived from the Hofstede cultural dimension model. They were also correlated with knowledge of respondents about various key antibiotic facts.

Results: The Eurobarometer dataset incorporated 26259 responses from all European Union (EU) countries except Cyprus. Using multiple regression, uncertainty avoidance and masculinity were identified as the two national cultural dimensions significantly associated with the use of antibiotics for CFSt (R-adjusted$=0.45$; $P<0.001$). After controlling for these cultural influences, individuals who stated they had received information about antibiotics in the previous year were also more likely to correctly answer antibiotic-related questions ($r=0.721$; $P<0.001$). The use of antibiotics for CFSt was found to be inversely correlated with respondents' knowledge that antibiotics are ineffective against viruses ($r=-0.724$; $P<0.001$) and that misuse will render them ineffective in the longer term ($r=-0.775$; $P<0.001$).

Conclusions: National cultural dimensions, especially uncertainty avoidance and masculinity, appear to have a very significant impact on inappropriate antibiotic use within European countries. Nevertheless, their influence can be reduced by making EU citizens more knowledgeable about antibiotics through appropriate messages and targeted campaigns.

Keywords: respiratory infections, Hofstede, infection

Introduction

Antibiotic resistance has become a major threat to public health, and is responsible for significant morbidity and mortality. According to a recent report from the European Centre for Disease Control (ECDC) and the European Medicines Agency, >25000 patients in the European Union (EU) die each year from infections caused by multiresistant bacteria.[1] Antibiotic use is widely regarded as a major driver of resistance,[2] especially in ambulatory care settings; a direct correlation has been clearly described.[3] For this reason, many countries have launched campaigns aimed at increasing awareness among both the general public as well as the medical and pharmaceutical professions.[4] Since 2008, the EU, through the ECDC, has encouraged public information campaigns on prudent antibiotic use in its member countries, by promoting a European Antibiotic Awareness Day (EAAD) on the 18 November.[5] Nevertheless, concerns have been raised that such campaigns are not having their anticipated effect.[6,7]

There is a significant difference in antibiotic consumption per capita between European countries.[8] Interestingly, this variation has a clear geographical pattern. Northern Scandinavian countries exhibit the lowest level of use, whereas the southern Mediterranean countries are consistently among the highest consumers in the EU.[9] Surprisingly, only a few studies have considered that this could be significantly influenced by cultural factors.[10]

Hofstede's model of cultural dimensions is one of the most popular approaches to analyse cultural differences between countries, with >9000 citations in peer-reviewed journals. It defines culture as the collective programming of the mind that distinguishes the members of one group or category of people

from another. Using data analysis from thousands of detailed interviews, conducted in 53 countries, Geert Hofstede has formulated a model showing that world cultures vary along consistent, fundamental dimensions, which can be grouped into specific constructs: power distance (PDI), individualism (IND), masculinity (MAS), uncertainty avoidance (UAI), long-term (versus short-term) orientation (LTO) and indulgence versus restraint (IVR) (Figure 1).[11,12] Each dimension carries a designated score, which varies from country to country. Therefore, it is possible to undertake correlation analysis with behavioural statistics to ascertain possible cultural influences.

In 2010, the European Commission published a Eurobarometer study that had been carried out between 13 November and 9 December 2009 within all 27 EU countries. The survey covered residents aged ≥15 years in each country. The basic design, identically applied to all countries, was a multistage, random probability assessment using a number of sampling points proportional to the population size. These data are freely accessible for use and further evaluation.[13]

Methods

For the purpose of the study, Eurobarometer data were extracted and related to the proportion of respondents, by country, who replied correctly to four questions assessing their knowledge that antibiotics: are not active against viruses; do not work on colds and flu; can become ineffective if used unnecessarily; and their use can potentially be associated with serious side effects. Also noted were the respective proportions of respondents, by country, who stated that they had taken at least one course of antibiotics in the previous year for colds/flu/sore throat (CFSt). Lastly, the proportion of respondents in each country who said that they had received information in the previous year about the importance of using antibiotics correctly was identified.

Individual scores for PDI, IND, MAS, UAI, LTO and IVR were accessed for each EU country from http://www.geerthofstede.nl/research--vsm/dimension-data-matrix.aspx. These scores were then correlated, by country, with the proportion of respondents who had taken antibiotics for CFSt. Multiple linear regression models were built in order to establish overall relationships; these were carried out using the backward stepwise technique utilizing, as the dependent variables, the proportions of people who had taken an antibiotic for CFSt. The adequacy of the models was confirmed through analysis of variance, the Durbin–Watson test for autocorrelation and collinearity diagnostics. Analyses were performed using Medcalc, version 9.2.1.0 (Medcalc Software, Mariakerke, Belgium) and SPSS, version 15 (SPSS Inc., USA). A P value of 0.05 was taken to indicate statistical significance.

Pearson correlation analysis was then undertaken between the proportion of individuals per country who stated they had received information about antibiotics in the previous year and the proportion of individuals who correctly answered all four antibiotic knowledge questions. Individual tests of association between the use of antibiotics for CFSt and correct reply to each of the four antibiotic questions were also performed. These were then repeated, but controlled for any cultural dimensions that were previously retained in the multiple regression model.

Power distance (PDI) relates to the extent to which the less powerful members of organizations and institutions accept and expect that power is distributed unequally. It suggests that a society's level of inequality is endorsed by the followers as much as by the leaders.

Uncertainty avoidance (UAI) indicates to what extent a society tolerates uncertainty and ambiguity, and shows how comfortable its members feel in unstructured situations that are novel, unknown, surprising or different from usual.

Individualism (IND) is the degree to which individuals are integrated into groups.

Masculinity (MAS) refers to the distribution of emotional roles between the genders. Masculine dimensions are very assertive and competitive.

Long-term orientation (LTO) fosters pragmatic virtues oriented towards future rewards; in particular, saving, persistence and adapting to changing circumstances.

Indulgence (IVR) stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun.

Figure 1. Hofstede definitions for the six cultural dimensions (adapted from http://www.geerthofstede.nl).

Results

Data were extracted for all EU countries participating in the 2009 Eurobarometer survey, with the exception of Cyprus, for which no Hofstede dimensional scores were available. These incorporated a total of 26259 responses (Table 1). The percentage of individuals who indicated that they had taken antibiotics for CFSt in the previous 12 months varied from 11% in Finland to 81% in Spain.

Significant correlations for inappropriate antibiotic use in CFSt were seen on univariate analysis with several Hofstede cultural dimensions, namely UAI, MAS, IND and IVR. However, the multiple regression model retained only UAI and MAS (R-adjusted=0.45; $P<0.001$) as significantly associated variables (Table 2).

Individuals who stated they had received information about antibiotics in the previous year were more likely to answer all four antibiotic knowledge questions correctly (uncontrolled: $r=0.578$, $P=0.002$; controlled for UAI and MAS: $r=0.721$, $P<0.001$). Furthermore, the proportions of respondents per country who answered all four antibiotic knowledge questions correctly were also found to be inversely correlated with the proportions who took antibiotics for CFSt (Table 3).

The use of antibiotics for CFSt was inversely associated at an individual level with knowledge that antibiotics are ineffective against viruses and that they do not work against colds and flu, as well as with awareness of the long-term impact of unnecessary use. However, when the correlation analysis was controlled for UAI and MAS country scores, only knowledge about

Table 1. Eurobarometer replies and national Hofstede cultural dimension scores by country

		Antibiotics taken for (%)				Knowledge of antibiotics (%)					Received information about antibiotics (%)	Hofstede scores					
Country	Number of responses	flu	sore throat	cold	all three reasons (CFSt)	do not kill viruses	not effective for colds and flu	needless use makes them ineffective	have side effects	all four		PDI	IND	MAS	UAI	LTO	IVR
Austria	1001	31	23	23	77	17	80	26	67	8	23	11	55	79	70	60	63
Belgium	1003	18	14	12	44	56	87	69	66	33	51	65	75	54	94	82	57
Bulgaria	1007	26	18	32	76	22	81	27	71	13	40	70	30	40	85	69	16
Czech Republic	1096	19	14	8	41	26	91	53	57	12	27	57	58	57	74	70	29
Germany	1522	23	8	11	42	31	84	33	74	15	32	35	67	66	65	83	40
Denmark	1008	10	10	3	23	52	96	65	72	37	47	18	74	16	23	35	70
Estonia	1000	13	7	15	35	32	78	48	78	18	21	40	60	30	60	82	16
Greece	1000	25	17	27	69	24	92	28	70	13	35	60	35	57	112	45	50
Spain	1023	32	25	24	81	23	88	32	70	12	51	57	51	42	86	48	44
Finland	1041	7	3	1	11	58	92	72	82	44	60	33	63	26	59	38	57
France	1005	8	14	7	29	58	87	64	69	33	67	68	71	43	86	63	48
Hungary	1017	22	31	23	76	27	75	29	50	9	19	46	80	88	82	58	31
Ireland	1014	15	15	5	35	45	89	55	69	25	31	28	70	68	35	24	65
Italy	1039	23	19	7	49	29	65	49	64	14	31	50	76	70	75	61	30
Lithuania	1027	19	10	19	48	20	82	29	74	11	26	42	60	19	65	82	16
Luxembourg	502	19	8	4	31	46	85	57	64	23	56	40	60	50	70	64	56
Latvia	1004	11	13	30	54	26	81	35	68	13	26	44	70	9	63	69	13
Malta	500	26	31	17	74	18	94	30	69	10	34	56	59	47	96	47	66
Netherlands	1004	4	4	4	12	52	93	66	55	27	15	38	80	14	53	67	68
Poland	1000	19	14	22	55	33	85	30	74	16	34	68	60	64	93	38	29
Portugal	1038	22	21	8	51	14	84	18	63	5	13	63	27	31	104	28	33
Romania	1008	20	10	40	70	14	57	28	50	4	33	90	30	42	90	52	20
Sweden	1014	6	8	3	17	73	97	68	68	39	38	31	71	5	29	53	78
Slovenia	1017	5	20	7	32	47	94	63	73	33	50	71	27	19	88	49	48
Slovakia	1047	24	27	7	58	29	90	46	74	20	43	104	52	110	51	77	28
UK	1322	12	10	7	29	50	89	65	69	31	26	35	89	66	35	51	69

Table 2. Individual correlation and multiple regression analysis between the proportion of respondents who took antibiotics for CFSt and national Hofstede cultural dimension scores

Cultural dimension	Correlation coefficient	*P*
Univariate analysis		
PDI	0.367	0.066
UAI	0.596	0.001
MAS	0.45	0.021
IND	−0.436	0.027
LTO	0.043	0.835
IVR	−0.437	0.025
Multiple regression		
constant	−2.384	
UAI	0.494	0.001
MAS	0.306	0.02
R-adjusted	0.449	
F-ratio	11.20	
P	<0.001	

Table 3. Correlation analysis between proportion of respondents who took antibiotics for CFSt with correct answers for antibiotic-related questions (uncontrolled and controlled for UAI and MAS)

	Uncontrolled		Controlled	
Knowledge	correlation coefficient	*P*	correlation coefficient	*P*
Antibiotics do not work on viruses	−0.824	<0.001	−0.724	<0.001
Antibiotics not effective for colds and flu	−0.437	0.026	−0.289	0.17
Antibiotics cause side effects	−0.227	0.265	−0.101	0.64
Unnecessary use makes them ineffective	−0.844	<0.001	−0.775	<0.001
All four answers correct	−0.811	<0.001	−0.694	<0.001

the ineffectiveness of antibiotics on viruses and the future repercussions of misuse were found to retain significance (Table 3).

Discussion

Antibiotic campaigns can be quite expensive initiatives. The French campaign run between 2002 and 2007 has been reported to have cost €100 million over the 6 years.[14] Even though significantly cheaper, the Belgian campaign still cost €400 000 a year.[15] In both cases, the reduction in antibiotic consumption rendered the investment cost-effective. Nevertheless, it is not a straightforward assumption to anticipate that decision-makers will immediately sign off requests for funding of such national initiatives. Indeed, financial support in EU countries, even just for the activities of the annual EAAD, has been far from universal.[5] It is therefore essential to establish a robust cross-national evidence base within Europe that validates the effectiveness of these initiatives within the region.

The results of this study clearly show that European citizens who have been exposed to information about antibiotics, and their appropriate use, are more knowledgeable about the subject. In turn, they are less likely to take antibiotics unnecessarily for respiratory infections of probable viral origin. The same Eurobarometer survey reported that 96% of EU inhabitants took antibiotics only following a prescription by a medical practitioner. Public campaigns equally impact on doctors and influence their prescribing habits.[16] In fact, the model identified no correlation between use for CFSt and PDI, a change from an earlier study that had used data collected before the EAAD and other antibiotic campaigns were introduced in Europe.[17] This could suggest that the recent EAAD and other campaigns may be influencing prescribing by empowering patients to resist unnecessary antibiotic prescriptions for CFSt from their doctors. Indeed, interventional strategies that improve doctor–patient communication and patient empowerment have been shown to be effective in reducing primary care antibiotic prescriptions.[18]

However, antibiotic campaigns have not been universally successful in all countries. Unlike in France and Belgium, national campaigns in other countries failed to show a significant reduction in antibiotic prescriptions.[7,19] Cultural differences could potentially explain some of these and other geographical differences in antibiotic use between European countries. Indeed, national UAI and MAS constructs can explain almost half of the variation of inappropriate use of antibiotics for CFSt reported in the Eurobarometer survey. UAI has already been suggested as a potential driver for unnecessary antibiotic use.[17] It would appear to be a logical choice. Mediterranean countries are among the largest users of antibiotics in Europe and also exhibit some of the highest UAI scores. High UAI nations exhibit a general intolerance of ambiguity and uncertainty. It is to be expected that patients in these countries are likely to find difficulty in accepting a recommendation to manage a viral upper respiratory infection simply through rest and symptomatic therapy. Physicians in high UAI countries are equally likely to feel uncomfortable when faced with a variety of mild symptoms, such as fever, cough and sore throat, and the diagnostic difficulty to fully exclude a potential, albeit unlikely, bacterial aetiology.[20] In such circumstances, antibiotics offer a psychological assurance in a situation of uncertainty to both patient and prescriber. There is already some evidence that would support this hypothesis. Harbarth *et al*.[21] reported significant differences in public perspectives, prescriber attitudes and levels of antibiotic use between Germany (UAI = 65) and France (UAI = 86). Similarly, differences in attitudes towards infections and antibiotic use have been noted between Flemish Belgians and Dutch residents just over the border in the Netherlands.[22] The former has one of the highest UAI scores in Europe, whereas the Dutch have one of the lowest. On the other hand, the association with MAS is a novel and very interesting finding. It could provide a possible sociocultural explanation for the relative failure of antibiotic campaigns in parts of the UK,[23] as well as the high level of ambulatory care antibiotic consumption in the USA.[24] Both countries score low on UAI, but very high on MAS. Countries with high MAS have a strong work ethos and their citizens are often described as 'living to work'. In such environments, antibiotics would be incorrectly regarded as vital medicines to get back to work as quickly as possible. This demand could then plausibly influence the prescriber, overtly or otherwise.[25]

The inclusion of cultural factors into antibiotic-related behaviour throws up a number of ponderables. National cultural dimensions are reputed to have been formed from core values in societies, which have evolved over hundreds, if not thousands, of years.[11] It will not be easy to change such behaviour in the short or medium term. However, the success in France suggests that improvement is possible, even in countries with a high UAI score. It should, nevertheless, be noted that after almost a decade of campaigns costing many millions of euros, France continues to be the third highest antibiotic consumer per capita in Europe.[9] In addition, antibiotic prescribing for respiratory infections that carry more aetiological and therapeutic uncertainty, such as bronchitis, sinusitis, otitis media and tonsillitis, showed little or no difference after the campaign.[26]

One possible way to address UAI is by adopting strategies that eliminate or, at least, reduce uncertainty in the population being targeted. Rapid near-patient tests for *Streptococcus pyogenes* offer significant promise, as they provide a visual assurance for both patient and doctor that the pharyngitis is not being caused by a bacterial infection. Indeed, a recent publication showed a moderate reduction in prescribing using this approach in Spain, another high UAI country.[27] It has been recommended that campaign messages need to be clear and simple, and that negative, fear-inducing statements should be avoided.[28] Above all, this study suggests that they also must be conducive with the culture of the country where they are applied. A message that the best remedy for colds and flu is just to rest at home has been commonly used in past EAAD campaigns;[4,5] however, it is not synchronous with high UAI and MAS cultures. On the other hand, an incontrovertible factual statement that viruses are not killed by antibiotics, and that their use will therefore not reduce the duration of illness, may be more assimilable and effective in such cultural backgrounds.

The greatest strength of this study was the extensive, and possibly unmatched, power offered by the Eurobarometer set of data. No previous European survey on antibiotic perceptions and practices has incorporated >26 000 respondents and genuinely encompassed the whole of the EU, stratified in terms of metropolitan, urban and rural areas. Eurobarometer data have very low whole-country confidence intervals, ranging from only

±1.9% for responses between 10% and 90% up to a maximum of ±3.1% for an observed proportion of 50%.[13] This supported accurate correlations. In addition, it concentrated on inappropriate use rather than total prescriptions, which is what many studies have looked at in the past.[4] The most important limitation was the same as that of any other study of association: correlation does not automatically infer causality. Nevertheless, cultural dimensions evolve from the core values of a society and easily pre-date modern medicine by centuries. It is logical to conclude that it is these fundamental values that then give rise to rituals, such as antibiotic-related perceptions and practices.

In conclusion, following analysis of published Eurobarometer data, this study suggests that cultural dimensions, especially UAI and MAS, may be significantly responsible for variations in the inappropriate ambulatory care use of antibiotics within European countries. Furthermore, they support a hypothesis that EU citizens who have been exposed to more information about antibiotics exhibit greater knowledge on the subject. In turn, they are less likely to take antibiotics unnecessarily for CFSt. Awareness that antibiotics are ineffective against viruses and that misuse will render them ineffective in the longer term seem to be particularly relevant. These inferences can prove useful to design better and more effective antibiotic campaigns in European countries.

Funding

This work was supported by internal funding.

Transparency declarations

None to declare.

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